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AUTHOR Kim, Yong-Wook; And Others
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ABSTRACT

This literature review examines whether verifiable evidence supports the supposition that early interventions result in better child developmental outcomes than later interventions for disadvantaged children with disabilities. First, existing reviews of the literature on the "earlier is better" supposition were examined. Second, a meta analysis on a database of articles that allowed exploration of the concept of early intervention was conducted. Finally, research reports which directly attempted to address the "earlier is better" supposition were reviewed. The paper concludes there is mild evidence to support the belief that earlier interventions lead to better outcomes for children with disabilities or from disadvantaged backgrounds. The evidence to support this claim is not overwhelming, however, and other intervention factors (such as location of services and severity of child risk) interact with the factor of starting age. Relatively little research was found which was designed to adequately and directly answer the "earlier is better" supposition. (Contains 33 references.) (DB)

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When Should We Begin? A Comprehensive Review of Age at Start in Early Intervention

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Yong-Wook Kim, Taegu University, Korea
Mark Innocenti, Utah State University, U.S.A.
Joung-Kwon Kim, Taegu University, Korea

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I. Introduction

The notion that "earlier is better" in regard to children entering early intervention program is widely accepted. Most interventionists support this supposition (White, Bush, Casto, 1985-86), the U.S. Congress has passed legislation that provides fiscal incentives for starting intervention early for children with disabilities (e.g., P.L. 99-457), and advocates of intervention for disadvantaged children have recently increased their calls for earlier intervention (Zigler & Styfco, 1993). However, the empirical evidence for this supposition is almost non-existent. In this review, I examine the evidence for whether earlier interventions result in better child developmental outcomes than later interventions. This review follows a three step process. First, reviews already in the literature that made statements regarding the earlier is better supposition were obtained. These literature reviews were examined to determine the degree to which the articles reviewed actually supported the earlier is better supposition. Second, a meta-analysis was conducted on a data base from articles compiled by the Early Intervention Research Institute at Utah State University. The articles in this data base were not specifically designed to address the earlier is better supposition, but they contained information that allowed this supposition to be explored. Finally, a literature search was conducted to identify articles which, as part of their primary research plan, directly attempted to address the earlier is better supposition. Only four primary articles were identified. Based on these combined sources of evidence, I suggest that there is mild evidence to support the belief that earlier interventions lead to better outcomes for children with disabilities and for disadvantaged children. However, this support is not overwhelming and it is clear that other intervention factors interact with the age at start variable. Another

concern raised by this review is that most available research is not designed to adequately answer the earlier is better supposition nor is of strong methodological quality. Although philosophically valid reasons exist for beginning children in intervention as early as possible, there is a need to conduct more research specific to the age at start question if we wish to maintain funding for early intervention options for our youngest children and families.

II. Evidence from Review of Reviews

Bronfenbrenner (1974), Casto and Lewis (1986), and Dunst, Snyder, and Mankinen (1989) all reviewed substantial numbers of research studies on effectiveness and age at start relationships. The reviews by Bronfenbrenner, and by Dunst, Snyder, and Mankinen covered a variety of issues about efficacy of early intervention program of which the age at start and effectiveness relationship was one. By contrast, Casto and Lewis' review was focused specifically on the relationship between age at start and efficacy of early intervention.

Bronfenbrenner (1974)

Bronfenbrenner conducted a review of 7 compensatory early education research projects which met the criteria they had set for the selection of a review. He included projects only if at least follow-up data were available for experimental and control groups and only if the data must be comparable from one project to another. Five of the projects involved intervention primarily in preschool settings and two were home-based. Of the 7 projects, he based his decision of age at entry on two projects with children from disadvantaged families. The first project consisted of three different groups starting in nursery, kindergarten, and first grade respectively. Results

on three different intelligence tests and other psychological measures revealed no significant differences among groups. However, he pointed out that the project provided no comparative data on parents' characteristics, such as education, occupation, or motivation.

Bronfenbrenner discussed on this issue with other project that reported gains in IQ achieved by thirty disadvantaged preschoolers who had entered the program at different ages, beginning with six months. An examination of gains in IQ scores between two groups also demonstrated no support to the conclusion of "earlier is better".

Bronfenbrenner addressed the role of age by stating: ". . . before the age of two, children from disadvantaged families tend to obtain normal scores on tests of mental development. Therefore, the level drops rather suddenly and may continue to decline in environments that are especially impoverished. Moreover, as the disadvantaged child gets older and enters school, he tends to get farther and further behind his classmates." And "Indeed, programs initiated at older age levels may not produced as large or enduring gains as those begun when the child is only two or three years old" (p. 10). However, the logic by which he reached these conclusions and the evidence on which they are based is not clear.

Casto and Lewis (1986)

In this review, the author examined the research evidence on age at start as a mediating variable in early intervention by the use of effect sizes. This type of review is referred to as a meta-analysis which is described extensively in the following section. They conducted a meta-analysis that yield 739 effect sizes dealing with age at start from research studies focused on children with disadvantaged, at-risk, and handicapped preschoolers age

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0-5. They found the average effect sizes for intervention studies with infants and preschooler when intervention was begun at ages 0-18 months was .41, and for those when intervention was begun at ages 18-36 months the average effect size was .48. The average effect sizes for studies where intervention began at ages 36 to 66 was .42. Thus, the data provides little support for "the earlier the better" assertion. They concluded that "the age at which intervention should begin for disadvantaged and handicapped preschoolers is still problematic" (p. 14).

Dunst, Snyder, & Mankinen (1989)

Dunst et al. did an extensive review of research based on the casual analysis of several categories such as intervention characteristics (e.g., age of entry, intensity of involvement, parent involvement, etc.), support characteristics (e.g., size of network, degree of helpfulness, reciprocity, etc.), family characteristics, child characteristic, and other explanatory variables. They separated studies in 14 groups based on the degree of methodological quality. They discussed research findings on the topic of age at start efficacy in total of 8 studies. Among them, surprisingly, they discussed this issues on only one study in the group that they judged to be of the best methodological quality. Even this study found that the outcome measure (Developmental Quotient) did not differ as a function of entry age.

In their review, Dunst et al. (1989) did not make any specific conclusion about the age entry hypothesis in early intervention programs since there was very little evidence and few number of studies that provided the impact of age entry. However, they favored "earlier is better" by stating, "The major conclusions that can be made from these studies is that a host of intervention (age of entry), . . . characteristics effect child, . . .

functioning as part of participation in early intervention programs" (p 281).

Conclusions From the Review of Reviews

Many studies in this area suffer from indirect comparison problem such as less comparing groups that begin intervention either earlier or later and methodological problems such as having substantial confounds of other variables (i.e. intensity/duration of program, parent involvement, or severity of disabilities). These problems make their validity suspect and unclear regarding the age entry hypothesis. Thus, the previous studies in this area are not conclusive largely because they are flawed by little empirical data exist, by methodological problems, and by inconsistent conclusions. It is safe to say that we still do not know how or whether age when intervention begins is related to the effectiveness of intervention.

The review of reviews does, however, provide some useful information. First, it is clear that evidence considered by past reviewers has been based only on indirect evidence about the issue of age entry. None presented evidence based on studies directly comparing programs of different age entries. Second, previous reviewers have implied that methodological quality of particular study is a major consideration for judging research (Dunst et al. 1989). Third, it is necessary to hold potentially confounding variables constant to examine the impact of age entry variable conclusively (Bronfenbrenner, 1974, Casto & Lewis, 1986; Dunst et al., 1989). Fourth, the use of a common metric appears to be a useful technique to discuss results across studies and aides reviewers in evaluating conclusions (Casto & Lewis, 1986).

III. An Age of Entry Meta-Analysis

Meta-Analysis

The "meta-analysis" techniques utilized to integrate the results of previous research were first proposed by Glass (1976). Briefly described, conducting a meta-analysis requires (a) the location of either all studies or a representative sample of studies on a given topic, (b) converting the results or outcomes of each study to a common metric, (c) coding the various characteristics of studies that might have affected the results (e.g., age of children, type and severity of handicap, type of outcome measured), and then (d) using correlational and descriptive statistical techniques to summarize study outcomes in ways that allow the examination of covariations of study characteristics with outcomes. In his critique of previous efforts to integrate the findings of research in the social sciences, Jackson (1980) concluded that the "meta-analysis approach is a very important contribution to the social science methodology. It is not a panacea, but it will often prove to be quite valuable when applied and interpreted with care" (p. 455).

Since its introduction, the meta-analysis approach has been used to review and integrate research findings on a wide variety of topics (Kavale, 1980; White & Myette, 1982). Researcher have raised questions about the use and interpretations of meta-analysis (Educational Research Service, 1980; Eysenck, 1978; Gallo, 1978; Mansfield & Bussey, 1977; Shaver, 1979; Simpson, 1979). Some have questioned the results of a specific meta-analysis, others have raised cautions or concerns about the methodology per se. Most of these criticisms and cautions have been responded to in the literature (Glass, 1978; Glass, McGaw, & Smith, 1981). Previous concerns about meta-analysis methodology suggest that precise implementation of the methodology and appropriate data analysis are key variables. The meta-analysis to be

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described here incorporated both variables.

Procedures for the Integrative Review

I used the data base compiled by the Early Intervention Research Institute (EIRI) at Utah State University (Casto & Mastropieri, 1986; Casto & K. R. White, 1987; K. R. White & Casto, 1985). From the over 400 studies in this data base, I used the 80 studies that reported information about the earlier interventions to investigate the relation between age entry and outcomes. The analysis reported here was based on studies for children with disabilities and also included studies of children who were economically disadvantaged. I calculated effect sizes based on the results. The researchers had not examined age entry factors (i.e., an independent variable) in the majority of these studies but presented information that allowed us to obtain information regarding age entry hypothesis.

It is also important to note that single studies could yield multiple effect sizes. For example, a study which compared an experimental group to a control group on language and motor functioning immediately at the conclusion of the intervention program would yield two effect sizes, one for language and one for motor functioning. More extensive explanation of the procedures utilized in the meta-analysis are available in Casto, White, and Taylor (1983).

Characteristics of Studies

I included only studies that had two or more groups that received intervention(s) at different age entries. To be included, age entries must be presented and different in each group. This resulted in the identification of 80 studies conducted mostly since 1970.

The meta-analysis yield 659 effect sizes dealing with age at start from research studies dealing with disabled and disadvantaged preschoolers ages 0-66 months. These effect sizes came from studies which compared intervention and control groups, and studies which compared one type of intervention with another type. The most studies focused primarily on measure of IQ as an indication of the importance of age at start in early intervention programs.

An overall summary of age at start which an intervention began is provided in Table 1. More than 60 percent of effect sizes came from studies where intervention began at ages 48 to 60 months.

Table 1. Entry Age of Earliest Group

Age in Months	#of Effect Sizes	Percent
<18	36	5.5
18-36	63	9.6
37-48	131	19.9
49-54	329	49.9
55-66	100	15.2

Table 2 depicts differences on age at start of interventions between groups in studies.

As may be seen from Table 2, most of studies examined the age at start comparisons with less than 4 months differences. In fact, near 50 percent of effect sizes came from studies compared groups with one month difference on age at start of intervention. Table 3 is provided to summarize the average effect sizes for intervention studies with disabled and disadvantaged preschoolers. As can be seen, there is a linear trend for the

Table 2. Differences Between Groups Upon Entry

Month Difference	#of Effect Sizes	Percent
1	307	46.6
2	181	27.5
3	73	11.1
4	24	3.6
5	11	1.7
6	19	2.9
7to12	28	4.2
13to16	16	2.4

Table 3

Effect Size Based on Age at Start of Intervention for Studies Examining Disabled, and Economically Disadvantaged Populations

Age by month	ES	SD	n
Disabled			
< 18	.18	1.28	18
18-36	.87	1.08	19
37-48	.39	.75	46
49-54	.22	.51	23
55-66	.18	.40	15
Disadvantaged			
< 18	.75	.39	14
18-36	.20	.37	37
37-48	.30	.48	85
49-54	.15	.61	306
55-66	.29	.57	85

disabled children when intervention was begun after 18 months. However, average effect size for intervention studies with disabled infants (0-18 months) was .18. A possible reason for this contradictory finding is that this result was confounded with severity of handicap. A similar pattern of

effect sizes can be seen on Table 6 which is presented by severity of handicap. The biggest effect sizes was shown in those studies in which interventions began at ages 18-36 months. For disadvantaged subjects, there is a moderate support regarding the age entry hypothesis. In studies where intervention began at ages 0 to 18 months, the average effect size was .75. In other words, intervention during these period produced gains of approximately three quarters of a standard deviation.

Next, Table 4 showed an analysis of the results from these comparisons of different levels of age entry whether the interve ntions were home-visit or center-based comparisons.

Table 4

Effect Size Based on Age at Start of Intervention for Studies Examining Disabled, and Economically Disadvantaged Populations Presented by Setting

Age by month	ES	SD	n
Home Based			
< 18	.45	.77	11
18-36	.33	.31	18
37-48	.16	.75	17
49-54	-.11	.72	8
55-66	-	-	-
Center Based			
< 18	.05	1.47	7
18-36	.61	1.25	16
37-48	.48	.72	41
49-54	.19	.56	255
55-66	.28	.57	92

Results from home-visit interventions are consistent with the age entry hypothesis. Similar results are presented in subjects from center-based interventions, but there is an exception for ages 0-18 months, which may be confounded by severity of handicap. Taken together the data provides support for "the earlier the better" assertion.

Another way of examining the validity of the age entry hypothesis is by controlling confounding variables. Next, we examine the effect of age at start with controlling potential confounding variable such as severity of handicap. This variable is mostly frequently cited in reviewing of early intervention efficacy research. As may be seen in Table 5, when all effect sizes except ages 0-18 months in severe category were considered there was support for the age entry hypothesis. Severely disabled infants--for whom the prognosis is generally least positive--are usually identified earlier than children whose handicaps are not as severe. In other words, the children entering intervention programs early may not be comparable to the older children who enter intervention programs.

Table 5

Effect Size Based on Age at Start of Intervention for Studies Examining Disabled, and Economically Disadvantaged Populations Presented by Severity of Disabled

Age by month	Mild			Moderate			Severe		
	ES	SD	n	ES	SD	n	ES	SD	n
Disabled									
< 18	1.35	1.48	6	.32	1.13	4	-.18	.58	15
18-36	.29	.38	8	.93	.42	4	1.51	1.52	7
37-48	.46	.52	11	-.01	.53	21	.98	.94	11
49-54	.52	.72	3	.09	.24	11	.27	.69	9
55-66	-	-	-	.15	.23	3	.18	.44	12
Disadvantaged									
< 18	.75	.39	14	-	-	-	-	-	-
18-36	.20	.37	37	-	-	-	-	-	-
37-48	.30	.48	85	-	-	-	-	-	-
49-54	.15	.61	306	-	-	-	-	-	-
55-66	.29	.57	85	-	-	-	-	-	-

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IV. Summary of Primary Research

Boyce, Smith, Immel, Casto, & Escobar(1933) examines the age-at-start issue for 58 medically at-risk infants born with very low birth weight(x = 1418g) with intraventricular hemorrhage(IVH). One group began motor intervention at three months of age and developmental intervention at 18 months. Comparison group received developmental intervention at 18 months. Majority were middle-income, western Caucasians. There were no statistically significant differences on developmental or family measures at 30 months. However, trend of some statistically significant differences were appeared on developmental measures at 42 months follow-up.

Mastropieri(1987) examines "the earlier one starts an intervention, the better" hypothesis for preschoolers with disabilities. 401 children who were identified as mentally retarded were selected from 36 counties located in rural, southwestern, geographic region. Intervention start age was correlated r=.125(p=.05) with the Bayley Mental Developmental Index (MDI) posttest score and r=.019(p=.41) with the Bayley Psychomotor Development Index(PDI) posttest score, indicating no significant relationship between intervention start age with Bayley PDI and mild relationship with Bayley MDI.

Reynolds(1933) examines the effects of the federally funded Child Parent Center preschool program on several cognitive and social outcomes with low-income, inner city, black children through 6th grade. Experimental group had 757 children with the average of age at start of 63.2 months. 130 children in control group started age at 64 months. Earlier participants were more competent than later participants in the areas of reading comprehension, mathematics achievement, teacher ratings of social adjustment, rates of grade retention, and special education placement at the end of kindergarten. Most outcome measures from grade 1through 6 demonstrated only weak, non-

statistically significant trends. Confounding factors were not controlled such as program intensity and quality of services.

Saylor(1994) studies systematic replication of Boyce et al(1993). There were68 infants born with very low birth weight (x=1169 grams)with IVH in the study. One group began motor intervention at three months of age and developmental intervention at 18 months. Comparison group received developmental intervention at 18months. Majority were low-income, southern, African-Americans. There were no statistically significant differences on developmental or family measures at 30 months or at follow-ups.

V. Summary and Future Directions

In this article, we used meta-analysis to examine the hypothesis that earlier interventions would result in better child outcomes than later interventions. Although there is widespread support in the literature for the age entry hypothesis, most of the support appears to be based on opinion (K. R. White et al., 1985-1986) and on limited, indirect reviews of the literature (Bronfenbrenner, 1974; Casto & Lewis, 1986; Dunst et al., 1989).

Analysis of evidence examining the age entry hypothesis by type of subjects and setting of the intervention, and by controlling confounded variables provides evidence that earlier interventions would be better for children who are economically disadvantaged or disabled.

Analysis of evidence examining the age entry hypothesis by type of subjects and setting of the intervention, and by controlling confounded variables provides evidence that earlier interventions would be better for children who are economically disadvantaged or disabled. Overall conclusions from three different approaches are in the followings:

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1. Overall, children benefit from early intervention begun at any age.
2. For children with disabilities (if you exclude data from children less than 18 months), and for the youngest disadvantaged children, the meta-analysis results provide mild support for the earlier is better proposition. However, multiple confounds exist in the research studies.
3. Meta-analysis data suggest potential interaction of age-at-start with child-risk factor, location of services, and severity of child risk.
4. Meta-analysis data have wide variability in study outcomes for children less than 18 months. This suggests the need for more studies focused on variables that may be interacting with intervention.
5. 85% of the meta-analysis studes had differences of 3 months or less between program entry for the different comparison groups. This may not be adequate for truly examining questions regarding earlier is better issues.
6. Primary research is mixed regarding the benefits of starting earlier. This research is very limited.

Future research will be most useful if it addresses the following issues:

1. In addition to IQ, researchers should measure other child outcomes. They need to consider developmental outcomes in relation to program goals (cf. Dunst et al., 1989). Also, area such as adaptive functioning, social skills, and academic survival skills need to be evaluated because they could have an impact on

future functioning (e.g., Speece & Cooper, 1990). The perceived effects of interventions on others in the child's environment also need to be assessed (Fleischer, Belgredan, Bagnato, & Ogonosky 1990).

2. Researchers need to include measures of parent and family functioning in their research, and they also need to examine interactions between family variables and types of intervention. If interventionists accept the tenants of an ecological model (Bronfenbrenner, 1979; Dunst, 1986; Dunst, Trivette, & Deal, 1988), then the need for measures of the parent, family, and environment are clearly called for.
3. Comparative studies of high methodological quality are criticalif we are to understand the impact of different age entry. Studies of high methodological quality will facilitate analysis of age entry and other program variables.

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